This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below and choose the interval the simplification is contained within.

$$8 - 6 \div 16 * 12 - (18 * 2)$$

The solution is -32.500, which is option C.

A. $[-30.3, -28.4]$

-29.000, which corresponds to not distributing a negative correctly.

B. $[43.6, 44.1]$

43.969, which corresponds to not distributing addition and subtraction correctly.

C. $[-32.9, -30]$

* -32.500, which is the correct option.

D. $[-28.5, -25.6]$

-28.031, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{24}{0}}$$

The solution is Not a Real number, which is option B.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Not a Real number

* This is the correct option!

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Irrational

These cannot be written as a fraction of Integers.

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{\frac{24}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-1716}{13}}$$

The solution is Not a Real number, which is option C.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

C. Not a Real number

* This is the correct option!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{132}i$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-1568}{14}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option B.

A. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

B. Pure Imaginary

* This is the correct option!

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 - 6i)(-7 - 5i)$$

The solution is $-86 + 2i$, which is option E.

A. $a \in [-28, -18]$ and $b \in [81, 84]$

$-26 + 82i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-87, -83]$ and $b \in [-4, 0]$

$-86 - 2i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-56, -53]$ and $b \in [29, 33]$

$-56+30i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

D. $a \in [-28, -18]$ and $b \in [-85, -80]$

$-26 - 82i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-87, -83]$ and $b \in [0, 5]$

* $-86 + 2i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 - 11i}{3 - 4i}$$

The solution is $-3.64 - 8.52i$, which is option A.

A. $a \in [-5.5, -3.5]$ and $b \in [-9.5, -8]$

* $-3.64 - 8.52i$, which is the correct option.

B. $a \in [-8, -6.5]$ and $b \in [5.5, 6.5]$

$-7.16 + 5.88i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-17, -14]$ and $b \in [1, 4]$

$-15.00 + 2.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-5.5, -3.5]$ and $b \in [-213.5, -212.5]$

$-3.64 - 213.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-91.5, -90]$ and $b \in [-9.5, -8]$

$-91.00 - 8.52i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 + 2i)(-10 + 4i)$$

The solution is $52 - 44i$, which is option E.

A. $a \in [58, 62]$ and $b \in [6, 15]$

$60 + 8i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [66, 71]$ and $b \in [0, 5]$

$68 + 4i$, which corresponds to adding a minus sign in the second term.

C. $a \in [45, 55]$ and $b \in [37, 45]$

$52 + 44i$, which corresponds to adding a minus sign in both terms.

D. $a \in [66, 71]$ and $b \in [-7, -1]$

$68 - 4i$, which corresponds to adding a minus sign in the first term.

E. $a \in [45, 55]$ and $b \in [-45, -43]$

* $52 - 44i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-36 - 11i}{6 - 2i}$$

The solution is $-4.85 - 3.45i$, which is option B.

A. $a \in [-5.99, -5.93]$ and $b \in [-1, 1]$

$-5.95 + 0.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-4.87, -4.85]$ and $b \in [-4.5, -3]$

* $-4.85 - 3.45i$, which is the correct option.

C. $a \in [-6.01, -5.96]$ and $b \in [4, 6]$

$-6.00 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-4.87, -4.85]$ and $b \in [-138.5, -137.5]$

$-4.85 - 138.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-194.02, -193.99]$ and $b \in [-4.5, -3]$

$-194.00 - 3.45i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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9. Simplify the expression below and choose the interval the simplification is contained within.

$$17 - 8 \div 15 * 9 - (13 * 5)$$

The solution is -52.800, which is option A.

A. $[-54.8, -50.8]$

* -52.800, which is the correct option.

B. $[-50.06, -44.06]$

-48.059, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[76.94, 82.94]$

81.941, which corresponds to not distributing addition and subtraction correctly.

D. $[-8, -0]$

-4.000, which corresponds to not distributing a negative correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{49}} + \sqrt{5}i$$

The solution is Pure Imaginary, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

C. Pure Imaginary

* This is the correct option!

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.
